Modelling Production of a *Salmonella* phage

Sílvio B. Santos, J. Azeredo and E.C. Ferreira
Centro de Engenharia Biológica, Universidade do Minho
Campus de Gualtar, 4700-057 Braga, Portugal

Phage therapy is complicated by the self-replicating nature of phage. The success of phage therapy is dependent on the knowledge of the phage replication kinetic properties in the presence of the host as well as on the prediction, controlling and optimization of phage production for future application. Moreover, it is necessary to evaluate and to understand the phage and bacteria population dynamics in order to foresee its potential for use in vivo.

To understand how natural communities are affected by environmental factors and will respond in time, it is important to develop predictive models. Mathematical models have been used for studying the dynamics of bacteriophage and, more recently, to evaluate its applicability in phage therapy. The kinetics of active phage therapy is based on the population dynamics of ecological predator-prey models and epidemiological host-parasite models. The value of simple models is to quantify the dominant factors that contribute to the population dynamics and to the evolution of the interactions between bacteria and phages.

The goal of this work was the development of a population dynamic model that predicts the interaction between a Salmonella phage and its respective host. Simulated data generated by the model was compared with the values obtained experimentally allowing to assess the suitability of the model. The suitability of the model was assessed first for small volumes but it is expected that the model may help the optimization of phage production and thus, a scale up of phage production was carried on in a 5L fermenter and results were compared with the simulated data. The phage-bacteria system showed similar behaviour and the simulation correlated well with the experimental results. We conclude that our model can be used to predict, and perhaps to optimize, the amount of phage obtained in the production process. The model might also guide experimental studies of population dynamics.